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Urceolariidae of gills of *Gobiidae* and *Cottidae* from Baltic Sea

Urceolariidae skrzeli *Gobiidae* i *Cottidae* Bałtyku

My previous studies on *Urceolariidae* of Adriatic fishes (Raabe, 1958) as well as the studies of Stryjecka-Trembaczowska (1953) on these protozoa of Baltic fishes turned my attention to the specificity of the species occurring in *Gobiidae* and *Blenniidae*. A similar specificity according to the studies of Dogiel (1948) and Poljansky (1951) appear to show *Urceolariidae* of *Cottidae*. In connection with this in Summer 1958 in the course of studies conducted in the Gulf of Gdańsk and in the Gulf of Puck I collected the material of *Urceolariidae* occuring on the skin, fins and gills of the regularly found in the Baltic Sea representatives of the families *Gobiidae* and *Cottidae*, namely: *Gobius minutus* L., *G. niger* L., *Cottus* (*Myoxocephalus*) *scorpius* L. and *C.* (*M*). *bubalis* Euphr. In these fishes I found the following species and forms of *Urceolariidae: Trichodina domerguei* (Wall.) f. *latispina* Dogiel, 1940; *Trichodina domerguei* (Wall.) f. *gobii* f. n.; *Trichodina cottidarum* Dogiel, 1948; *Trichodinella baltica* (Stryjecka-Trembaczowska, 1953); *Dogielina simplex* g. n., sp. n.

The examined material, besides observations in vivo, was fixed in Schaudinn's fluid and stained with Mayer's acid hemalaun, iron hematoxylin Heidenhain's or was impregnated in the dry state with silver-nitrate according to Klein. As in my previous works, I decided to base my observations to a considerable degree on the silver-nitrate impregnated preparations, which offer precise and clear pictures of the examined forms and their taxonomic characteristics.

Trichodina domerguei (Wall.) f. *latispina* Dogiel, 1940

This form was previously (Raabe, 1959) identified with the typical form described by Wallengren (1897) of the gills and skin of *Gasterosteidae*. It occurs in the Baltic Sea on *Gasterosteidae* and *Syngnathidae* so regularly that the representatives of the two families of fishes can be regarded as its typical hosts in the salty waters of the Baltic Sea.

In the course of the present studies it appeared that *T. domerguei* f. *latispina* Dogiel is still more ubiquitous: in the Gulf of Gdańsk and in the Gulf of Puck I have found it also on the fins, skin and sometimes also on the gills of *Gobius minutus* and *G. niger*, and also on the gills of *Cottus* (*M.*) *scorpius*. However, in those fishes it occurs not frequently and in small numbers, whereby on the gills it occurs among other, clearly dominating over it species or forms of *Urceolariidae*, specific to the given species of fish. A similar form was found by Stryjecka-Trembaczowska (1953) on the gills of *Gobius flavescens;* in my present studies I did not come across with this species of fish.

It seems to me that *T. domerguei* f. *latispina* Dogiel can be regarded as an unspecific and accidental parasite of the named *Gobiidae* and *Cottidae*, transferred on them in the course of contacts with *Gasterosteidae* or *Syngnathidae*. Its taxonomic separateness is illustrated by the preservation of its proper dimensions and number of hooks, clearly different from the dimensions and other taxonomic characteristics of even closely standing forms, as e. g. *T. domerguei* f. *gobii* f. n. occurring in great numbers on the gills of *Gobius minutus*.

The dimensions of representatives of *T. domerguei* f. *latispina* Dogiel of *Gobiidae* and *Cottidae* correspond strictly to the dimensions of this form of *Gasterosteidae* and *Syngnathidae* (Raabe, 1959); they are as follows: diameter of the adhesive disk 51—64 μ (one specimen 75.5 μ), diameter of the denticulate ring 27—36 μ (one specimen 42.5 μ), number of hooks 22—29, number of striae of the peripheric zone of the sucker corresponding to one denticle of the denticulate ring 8—9 (one specimen 13!).

Trichodina domerguei (Wall.) f. *gobii* f. n.

I found constantly the *Trichodina* of this form on the gills of *Gobius minutus* L. of the Gulf of Puck and of the Gulf of Gdańsk,

whereby it occurred on almost 100 per cent of the examined representatives and the infection was sometimes very intense.

Shape of the body characteristic for the species, usually rather flat; dimensions of the body: diameter 25—35 μ, hight ± 12 μ. Adoral spiral 20 μ in diameter. Nuclear apparatus: macronucleus sausage-like, in outline rather regular, describes an arc of roughly 300°

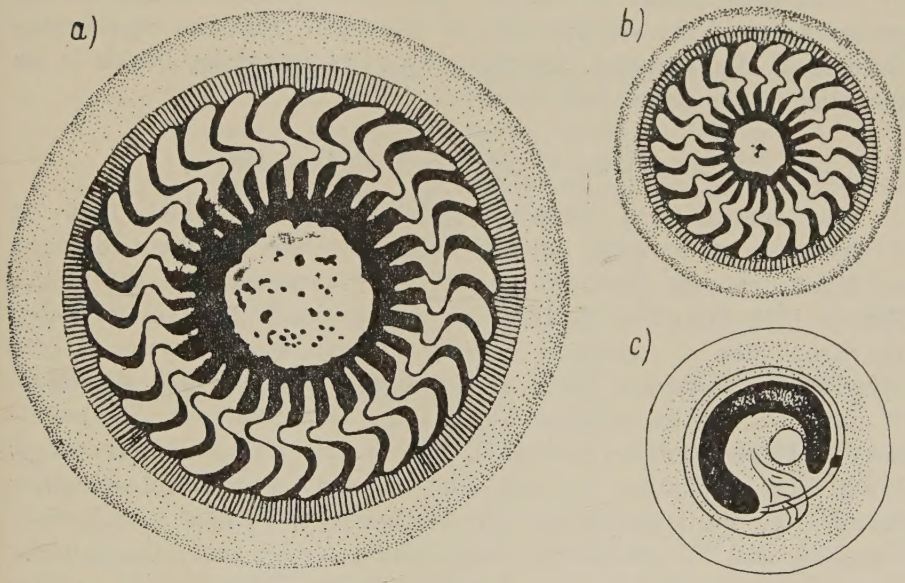

Fig. 1. a — *Trichodina domerguei* f. *latispina* Dogiel from the skin of *Gobius minutus*, the aboral side, $AgNO_3$, × 1200; b — *Trichodina domerguei* f. *gobii* f. n. from gills of *Gobius minutus*, the aboral side, $AgNO_3$, × 1200; c — *T. dom.* f. *gobii* f. n. from the oral side, I. H., × 1200.

of a radius ± 9 μ; micronucleus located close to one of the ends of the macronucleus.

The denticulate ring of the adhesive disk consists of denticles provided with broad, sicle-like curved and slightly rounded at the ends extrorse hooks and slightly bent introrse spikes, corresponding by the shape to the spikes and hooks of other forms of this species. The number of hooks fluctuates between 19 to 23, most commonly 20 or 21. Diameter of the sucker 25—35 μ, average 30 μ; diameter of the denticulate ring 13—18 μ, average 15.5 μ; length of hooks measured from the centre of the denticle 3.5—4.5 μ, average 4 μ; length of spikes 3—4 μ, average 3.5 μ. Number of striae of

the peripheric zone of the sucker corresponding to one denticle of the denticulate ring 6. In silver-nitrate impregnated preparations the centre of the sucker remains bright and is sharply outlined against the zone occupied by the introrse spikes.

T. domerguei f. *gobii* f. n. is allied to *T. domerguei* f. *pleuronectes* Stryj.-Tremb. or *T. domerguei* f. *jadranica* Raabe. It differs from them by certain peculiarities of the outline of hooks and by small dimensional differences. Due stress should be laid on the preservation of the separateness of this form from the representatives of *T. domerguei* f. *latispina* Dogiel occurring beside it on the gills of the same individuals of fishes.

Trichodina cottidarum Dogiel, 1948

This species was initially described by Dogiel, 1940 as *T. domerguei* f. *borealis*, whereby this form was supposed to occur on *Myoxocephalus quadricornis* and on *Pleuronectes* in the White Sea. In 1948 Dogiel described a new species of the Gulf of Peter the Great (Sea of Japan): *T. cottidarum* with several forms: *T. cottidarum* f. *cottidarum* Dog. from various *Cottidae* and *Agonidae*, *T. cottidarum* f. *hemitripteri* Dog. from *Hemitripterus* (*Scorpaenidae*) and *Ceraocottus* (*Cottidae*), and *T. cottidarum* f. *alcichthys* Dog. from *Alcichthys*. In 1951 Poljansky differentiates further forms from the Barents Sea: *T. cottidarum* f. *barenzi* Polj. from *Cottidae*, and *T. cottidarum* f. *cyclopteri* Polj. from *Cyclopterus lumpus*, and in 1954 Stein described in the Baltic Sea *T. cottidarum* f. *maris-albi* Schulman-Albowa, 1953 from *Enchelyopus cimbrius* (*Gadiformes*). Independently of this, from the primary *T. domerguei* f. *borealis* Dogiel, Stryjecka-Trembaczowska differentiated from *Pleuronectidae* populations described as *T. domerguei* (=*T. pediculus*) f. *pleuronectes*, and points to the differences between it and the form from *Cottidae*.

In 1948 Dogiel discussing the problem of differentiating the species *T. cottidarum* draws attention to the lacation of the micronucleus in this form on the elongation of the arm of the macronucleus and not in its concavity as it appears in the form from *Pleuronectes*. The author points also to other differences and states: „If on *Cottidae* and *Pleuronectes* the same form of *Trichodina* were living, then the *Pleuronectes* of the Sea of Japan, where the *Cottidae* are very strongly infected with *Trichodina*, should exhibit also their invasion. As a matter of fact this is not the case and can

be aesily interpreted if accepted that in *Pleuronectes* parasitizes a separate species, occurring in the White Sea but absent in the Sea of Japan" (Dogiel, 1948, p. 57).

The problem of the separateness of *T. cottidarum* Dog. seems to be clear, but none of the Russian authors presented a satisfactory picture of morphological differences, which would differentiate this species from other species, particularly no description of

Table I

Trichodina cottidarum f. *cottidarum* Dogiel, 1948

	Dogiel, 1940 White Sea	Dogiel, 1948 Japan Sea	Str.-Tremb. 1953 Baltic Sea	Poljansky, 1955 Barents Sea	Raabe, 1958 Baltic Sea	Summary
body Ø	41 38—45	33—39	36 23—53	33—39	40 31—45	23—53
adh. disk Ø	25—37	17—27	31 22—41		40 30—45	17—45
dent. ring Ø		12.6—19	18 13—26	13—19	21 17.5—24	12.6—26
No. of denticles	22 20—28	20—22 18—29	20—22 19—26	11*—29	22—23 20—25	18—29
No. of striae		3×2	8	3×2	7—8	6—8
macron. Ø			23 17—37	18—24	28 25—34	17—37

* Probably after division! (Z.R.)

the silver adsorbing system, so important for the taxonomic diagnosis was given. All the authors attempted only to show the biometric differences, which are more or less distinctive and very various in the various forms of *T. cottidarum* Dog., and which are even more divergent in the individual forms of *T. domerguei* (Wall.).

In my material I dealt with the populations of *Trichodina cottidarum* Dogiel, 1948 from the gills of *Cottus scorpius;* simultaneously I made use of the materials elaborated by Stryjecka-Trembaczowska from the gills of *C. bubalis.* Beside this, for comparative purposes I used also the material collected by my coworker A. Lisiecki from the gills of *Enchelyopus cimbrius,*

which I had the right to regard as representing *T. cottidarum* f. *maris-albi* Sch.-Albowa, the form described also from this fish in the Baltic Sea. The differences between the studied by me forms from *Cottidae* and *Enchelyopus* are only numerical, of the order permitting at best to regard them as separate forms of undoubtedly one species — I am not intending to discuss this problem in detail.

I am presenting a description of the ciliates found by me on the gills of *Cottidae*, which I regard as *T. cottidarum* f. *cottidarum* Dogiel, 1948:

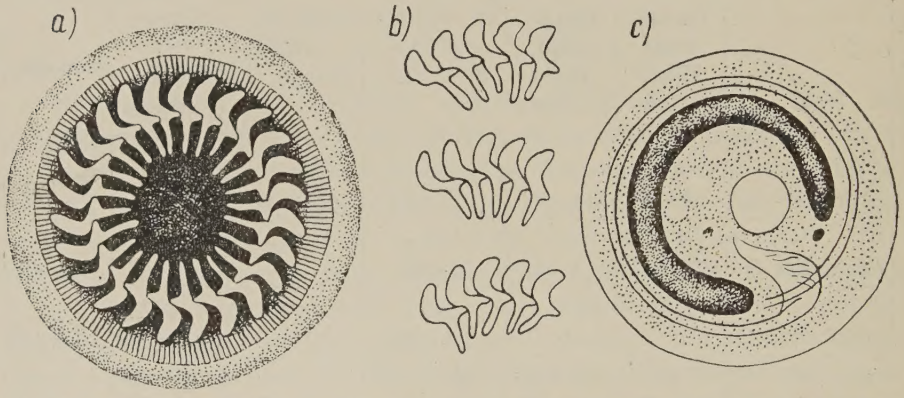

Fig. 2. *Trichodina cottidarum* Dogiel. a — the aboral side, $AgNO_3$, × 1200; b — various forms of denticles; c — from the oral side, I. H., × 1200.

Shape of body similar of that of *T. domerguei* (Wall.), usually rather flat; dimensions of the body are shown in the enclosed table. The adoral spiral diameter 31—36 μ, describes an arc of about 400° as in other *Trichodina*. Nuclear apparatus: macronucleus sausage-like, of a rather irregular outline, describes an arc of about 300°, of a diameter 25—34 μ; micronucleus located on the elongation of one of the arms of the macronucleus (not beside it neither in its concavity as in *T. domerguei*).

The denticulate ring of the adhesive disk consists of firmly connected links; in silver impregnated preparates due to specific arrangement of the sockets of the bodies of the links they seem to just loosely connected together. The bodies are provided with strong, arch-like bent and sharp extrorse hooks, markedly narrower than in *T. domerguei* (Wall.), and long introrse spikes, straight or even slightly bent on the ends to the opposite side than

the hooks (therefore differently than in *T. domerguei*). The number of hooks fluctuates from 20 to 25. Length of hooks, counting from the centre of the denticle 3.5—4.5 μ, average 4 μ; length of spikes 4—5 μ, average 4.5 μ. Number of striae of the periphery of the sucker 7—8 per 1 denticle; sometimes they are arranged in pairs. The centre of the adhesive disk is dark in silver impregnated preparations as are the areas between the spikes (bright spaces so characteristic to *T. domerguei* is absent here).

Trichodina cottidarum Dogiel, 1948 differs therefore sufficiently from all the known to me forms of *T. domerguei* (Wall.) by the very characteristics, which unite them together: different shape of hooks and spikes, different connection of denticles of the denticulate ring, different character of the centre of the adhesive disk. To stress even more the separateness of the two species it should be added that the *T. domerguei* f. *latispina* Dogiel, 1940 found by me singly on the gills of *Cottus scorpius* preserved wholely its separateness in relation to *T. cottidarum* f. *cottidarum* Dogiel, 1948. In view of this *Trichodina cottidarum* Dogiel, 1948 should be treated as a good species, which provides various, closely linked forms on the gills of various fishes from various areas.

Trichodinella baltica (Stryjecka-Trembaczowska, 1953)

This species described from the gills of *Gobius niger* L. as *Brachyspira baltica,* was found by me also exclusively on the gills of this species of fishes. It occurred in various, usually not too great intensity and extensity. I found it most frequently in *Gobius niger* living in large populations on subwater meadows in the Gulf of Puck near Swarzewo. It occurred here in about 20 per cent of fishes either as the only species and then somewhat more numerously, or together with *Dogielina simplex* g. n., sp. n. and then in very small numbers.

Analogously to *Trichodinella epizootica* (Raabe, 1950) Šramek-Hušek, 1953, the *Trichodinella baltica* (Stryj-Tremb.) is provided with a specific structure of the adoral spiral and denticulate ring, markedly differentiating them from all the species of the genus *Trichodina.*

Trichodinella baltica (Stryj.-Tremb.) is of a cap-like shape but the hight does not on the whole surpass the diameter: body diameter 18—24 μ, hight ± 10 μ. Adoral spiral describes an arc of

about 180° of a radius ± 10 μ. Nuclear apparatus: macronucleus of a horse-shoe shape with arms usually widened, diameter of the arc about 11 μ; micronucleus faces the end of the macronucleus.

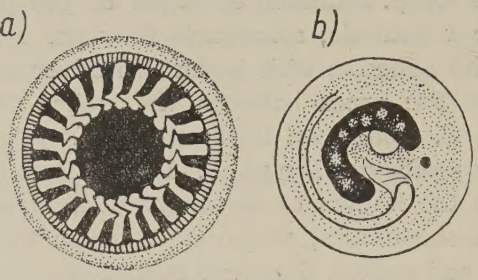

Fig. 3. *Trichodinella haltica* (Stryj.-Tremb.) a — the aboral side, $AgNO_3$, × 1200; b — from the oral side. I. H., × 1200.

The denticulate ring consists of denticles provided with straight, truncheon-like extrorse hooks and completely deprived of introrse spikes. Also the introrse part of the socket of the body of the link is considerably reduced, while the extrorse part bearing the hook is well developed. In silver-impregnated preparates this causes the appearance of a characteristic picture: it seems at the first glimpse that the sockets of the links are turned to the opposite direction than in *Trichodina*. The number of denticles fluctuates from 19 to 24, most commonly there are 21. Diameter of the adhesive disk 18—24 μ, average 22 μ, diameter of the denticulate ring 10—13.5 μ, average 12.5 μ; length of hooks measured from the centre of the denticle 2.5—4 μ, average 3 μ. Number of striae on the periphery of the adhesive disk, corresponding to one denticle is 5. In silver nitrate impregnated preparations the centre of the adhesive disk is dark.

Of all the fishes known to me from the Baltic Sea and its gulfs, and elaborated by me and Stryjecka-Trembaczowska, *Trichodinella baltica* (Stryj.-Tremb.) occurs only in *Gobius niger*. Explanation should be given as regards the relation of this species to *Trichodinella epizootica* (Raabe) known from fresh-water.

Dogielina simplex g. n., sp. n.

I found this species exclusively on the gills of *Gobius niger* L. from various areas of the Gulf of Puck and the Gulf of Gdańsk, whereby in some fish populations this species occurred at a 100 per

cent extensity, in others at a somewhat lesser per cent, usually singly, rarely only accompanied by *Trichodinella baltica* (Stryj.-Trembl.). Sometimes the infection of fishes was massive.

This species differs so markedly from other forms of *Urceolariidae* as regards essential details of structure, that I do not hesitate to describe it as a representative of a separate, new genus. These

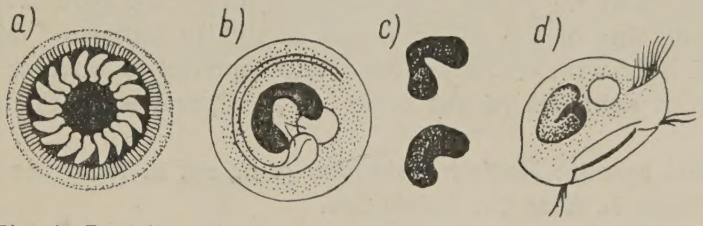

Fig. 4. *Dogielina simplex* g. n., sp. n. a — the aboral side, $AgNO_3$, × 1200; b — from the oral side, I. H., × 1200; c — lateral view.

characteristics are above all: the adoral spiral, which describes an arc of about $^3/_4$ of the circumference, therefore about 270°, and the specific, very simple structure of the denticles of the denticulate ring.

Shape of body cap-like, frequently very prominent, whereby the abridged adoral spiral clearly separates the prominent adoral part from the widened basic part. Body diameter: 10—22 μ, average 18 μ; height 7—16 μ, average 12 μ. Adoral spiral describes an arc of about 270°, a radius ± 17 μ. Nuclear apparatus: macronucleus horse-shoe like of strongly extended arms, sometimes in the form of two spherical structures united by a thin ligament, of very various dimensions; the string of the horse-shoe most commonly 10 μ. Micronucleus was not observed.

The denticulate ring consists of denticles provided with strong straight extrorse hooks, looking like triangular blades of knives; there is a total lack of introrse spikes and the denticles are not firm and are considerably compressed. The number of hooks fluctuates between 17 to 20, most frequently 18. Diameter of the adhesive disk 15.5—22 μ, average 18μ; diameter of the denticulate ring 6.5—9.5 μ, average 8 μ; length of hooks counted from the centre of the denticle about 2 μ. Number of striae on the periphery of the adhesive disk, corresponding to one denticle 4. In silver impregnated preparations the centre of the adhesive disk is dark.

Dogielina simplex g. n., sp. n. is the smallest from the known species of *Urceolariidae*, and among species provided with armed denticles of the denticulate ring it has the simplest structure.

Dogielina g. n.

Urceolariidae provided with an adoral spiral, which describes an arc of about $^3/_4$ of the circumference, therefore about 270°. The denticulate ring of the adhesive disk of tightly connected denticles, provided only with extrorse hooks, but deprived of introrse spikes. Number of denticles of the order of 20. Parasites of the gills of fishes.

Typical species: *Dogielina simplex* g. n., sp. n. from the gills of *Gobius niger* L. from the Baltic Sea.

General notes

The representatives of the family *Urceolariidae* found by me on the gills of *Gobiidae* and *Cottidae* exhibit interesting differences of two structures not only essential taxonomically, but also important to systematic-phylogenetic and evolutional studies.

The first of the two structures — adoral spiral — shows in the studied forms three shapes: shape of a full spiral over 360° (obout 400°), characteristic to all *Trichodina* and also to *Urceolaria*, shape of an shortened spiral to about 270°, which appears in *Dogielina simplex* g. n., sp. n. and finally the shape of a spiral, which describes barely an arc of about 180°, and which appears in representatives of the genus *Trichodinella* Šramek-Hušek (=*Brachyspira* Raabe) and also in the genus *Semitrichodina* Kazubski, 1958. It should be reminded that among *Urceolariidae* there appears one more type of the adoral spiral, namely one which describes 2—3 turns and which characterizes the genus *Vauchomia* Mueller, 1938.

The second structure is the denticulate ring of the adhesive disk, the surface construction of which is particularly apparent in silver-nitrate impregnated preparations. To all *Trichodina* and *Semitrichodina* significant is the strong body of the denticle, appearing in the form of a socket, which unites by its edge with the excavated centre of the socket of the next denticle and is provided with a strong extrorse hook, often curved and flattened and with a thinner introrse spike. The compactness of the denticles, the degree of

their wedge-like junction, the shape of spikes and hooks can be various as apparent from differences between *T. domerguei* and *T. cottidarum* or other species (e. g. R a a b e, 1958). In *Trichodinella* the denticles of the denticulate ring are characterized by complete reduction of not only the introrse spikes but there appears also a considerable reduction of the introrse parts of the socket of the body of the denticle, which support them. The strong extrorse part of the socket supporting the hook left to herself creates a specific picture of the denticle, which is particularly striking in silver

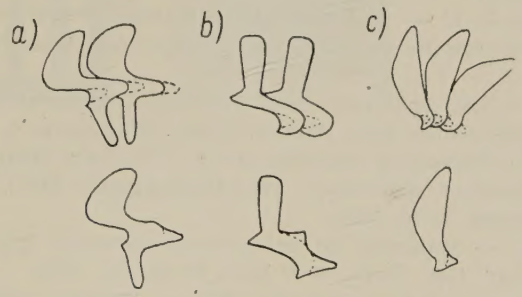

Fig. 5. The denticles of *Trichodina* (a), *Trichodinella* (b) and *Dogielina* (c).

impregnated preparations. The denticles of the denticulate ring in *Dogielina* g. n. present a different picture; here also is the absence of the introrse spike, but the denticle became uniformly shortened, remaining narrow and compressed between the neighbouring denticles. Again should be reminded the denticulate rings provided with completely smooth bodies od the denticles, deprived of spikes and hooks, as seen in *Urceolaria* and several other genera.

This diversity of the structure of such important organs indicates undoubtedly the essential differences in the way of the prehension of food, in the way of contacts with the substratum, and in advancement of the adaptation to the parasitic life among *Urceolariidae*.

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STRESZCZENIE

Autor, zainteresowany swoistością *Urceolariidae* ze skrzeli *Gobiidae* i *Cottidae*, zbadał przedstawicieli tych rodzin ryb z Zatoki Gdańskiej i Zatoki Puckiej i stwierdził występowane u nich 5 form *Urceolariidae*. Są to: ubikwistyczna i występująca na skrzelach wielu ryb *Trichodina domerguei* f. *latispina* Dogiel 1940, swoista dla *Gobius minutus* forma tegoż gatunku *T. domerguei* f. *gobii* f. n., właściwa przedstawicielom rodziny *Cottidae*—*Trichodina cottidarum* f. *cottidarum* Dogiel 1948, swoista jak się wydaje dla *Gobius niger* i poprzednio opisana z Bałtyku *Trichodinella baltica* (Stryjecka-Trembaczowska 1953) oraz nowa forma, o wyróżniającej się budowie, swoista również dla *Gobius niger* — *Dogielina simplex* g. n., sp. n. Autor podaje dokładne opisy form znanych lecz niedokładnie opisanych oraz znalezionych przez siebie form nowych i wskazuje na istotne różnice w ich budowie.